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Computer-Aided Value-Assessment Model: Review for Bilingual Teaching Courses Quantitative Analysis

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Abstract

In order to review the effect on the bilingual teaching courses aided by computer, the comprehensive evaluation on the bilingual teaching course and research results of the bilingual teaching is required in the university. A full range system for bilingual teaching course performance assessment that is a novel quantized method is researched in this paper. Furthermore, the comprehensive evaluation processing and evaluation model have been accomplished. The application results for bilingual teaching course performance review assessment which is developed as a computer management system demonstrated its high operability and achieved accurate can be convenient for the same requirements.

Keywords: Bilingual teaching, value-assessment model, comprehensive evaluation, quantitative criteria

1. Introduction

The higher education in our county has been made worldwide achievements which supported a strong talent and intellectual for our innovative country built. In order to make further efforts and sustainable competitive advantage for popularization of higher education, the bilingual teaching courses was used to undergraduate students which is suggested by Ministry of Education of the People's Republic of China since

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2001. The bilingual teaching courses had been used for undergraduate students in early 1980 such as University of Electronic Science and Technology of China, which were brought from MIT by Sheng-gang LIU who is an academician of Chinese Academy of Sciences (CAS) and the Guest Professor of MIT.

Many researchers focus on the teaching methods and assessment model or architecture on bilingual teaching course. Most of researched results are based on the single course such as reference [1] to [4]. Few assessment model of bilingual teaching course were deal with such as reference [1], reference [3], and the reference [4]. As we know that the teaching effect is the most important on the bilingual teaching. It relate to lots of aspects in the teaching activities such as teachers, students, text books, the methods and means of teaching, and so on. Some quantitative criteria are researched, and some different technologies are used to determine the effect results. Graduate qualities with English and computer as two basic skills was discussed in reference [1], the syllabus of "Quality Management" was given in reference [2], the social-educational model and the input-output model of bilingual education were researched in reference [4]. Reference [5] and Reference [6] used the BP artificial neural network to evaluate the bilingual teaching. However, the input sample training data for the BP neural network is very complex in the evaluation application system.

2. Quantization and Comprehensive Methods for Evaluating Indicator

On the deepen reform and strengthen the sense of quality requirements to be continued for bilingual teaching courses in our higher education, the most critical for enhance the quality of bilingual teaching and reaching is improving the quality and level of the courses teaching effect and the teachers who teach the bilingual courses in university. Thereby, the quantization and comprehensive methods for evaluating indicator should be researched first. The reference [7] and [8] can be considered at the model built. However, there are more nondeterministic, nonfigurative and soft signs in the assessment criteria, but less quantitative, detailed, exact or hard signs for the bilingual courses in the assessment criteria.

Ten aspects from various angles to evaluate the bilingual teaching teachers and the courses which include course chosen selected to teach by bilingual teaching, English level, overseas working, researching or education background, on-class teaching evaluation, daily management, teaching material construction, research achievements on bilingual teaching and scientific, honors and awards, others work, and teaching accident respectively. In order to get objectively an evaluation results comparable, the relative quantitative evaluation followed the criteria that performance assessment should be more use of quantitative indicators.

2.1. Quantification of Qualitative Factors

The "excellent", "good", "medium", "general", "unqualified" (Represented by A, B, C, D, and E respectively) are used to represent for the quantitatively difficultly describe factors as multiple grade standard. Quantitative estimation by scoring, etc. is given which is based on the qualitative analysis. So the results have mathematical statistical properties.

For example, the evaluation of the teaching approach can be used to express satisfaction. Assume there is n individual evaluation factors of the teaching attitude for a teacher, and x individual estimation is "excellent" or "good", then define the degree of satisfaction is x/n. It can also use the scores to indicate such as quantize A, B, C, D, and E to the scores of 90, 80, 70, 60, and 0 respectively. Consider there are n individual estimations, and the results with A, B, C, D, and E are x_1, x_2, x_3, x_4 and x_5 respectively. That is $n = x_1+x_2+x_3+x_4+x_5$.

Let E= (x_1, x_2, x_3, x_4, x_5) and Q= (90, 80, 70, 60, 0), Then the score is E×Q T/n, and it can be used in the application systems.

2.2. Quantification of Quantitative Factors

It should be amended for some quantitative factors because of it can not explain the situation well or not for tasks implemented completely. For example, bilingual course workload of teaching (represented by class hours), consider a teacher have finished n class hours, but it can not show the quantitative factors more or not. We get the average workload x of the department or the university, and define the value P is the evaluating factor which come from compare with n and x. We select the evaluating indicator value $P=60+(n-x)/x*100$, and define P=100 when P more then 100, and P=0 when P less then 50.

2.3. Comprehensive Methods

A linear sum of weighted is used to make the comprehensive assessment, that is $Y=\sum W_i \times R_i$.

Here, Y is the value of comprehensive assessment, W_i is i-th evaluating indicator, and the R_i is i-th weight coefficients.

3. Evaluation Model and Methods

3.1. Evaluation Methods and Calculation Models

In order to comprehend and maintenance convenient, we use the vector to represent the evaluation factors, evaluation results, and the weight coefficients, and it can be run calculation fast.

1) Bilingual Teaching Evaluation

Bilingual teaching evaluation vector $\boldsymbol{M}_1=(m_1, m_2, \ldots, m_5)$, here m_1 to m_5 is represented the results given by student assessment, assessment of teachers listening, assessment of colleagues, assessment of department heads, and assessment of supervisors respectively. The teaching evaluation coefficients vector $\boldsymbol{R}_1=(r_1, r_2, \ldots, r_5)$, here r_1 to r_5 are represented the weight coefficients for the each factors above respectively. It reflects the significance grade for each other. Bilingual teaching scores $\boldsymbol{S}_1=\boldsymbol{M}_1\times\boldsymbol{R}_1^{\mathrm{T}}$.

Let $\boldsymbol{Q}_1=(90, 80, 70, 60, 0)$, $\boldsymbol{M}_{11}=(m_{10}, m_{11},\ldots, m_{19})$, $\boldsymbol{R}_{11}=(r_{10}, r_{11}, \ldots, r_{19})$.

Here, m_{10} to m_{19} represented the observance by bilingual teaching regulations for lectures; freshness for lectures, good work attitude, preciseness style; clear thinking, concept accurate; adept courses to be taught, give prominence to key areas; integrate theory with practice; attention to inspire and guide students to actively thinking; interact frequently between teacher and students, lively classroom atmosphere; rational and effective use of teaching methods; correct homework earnestly; the overall evaluation score for teachers respectively. r_{10} to r_{19} are the weight coefficients for the 10 aspects of the student assessments.

Assume there are n assessments of the students, for the m_{1i}–th (i=0…9) assessment, the assessment results of A, B, C, D, and E are x_{ai}, x_{bi}, x_{ci}, x_{di}, and x_{ei} respectively. Let $\boldsymbol{E}_{1i}=(x_{ai}, x_{bi}, x_{ci}, x_{di}, x_{ei})$, then

$x_{ai}+x_{bi}+x_{xi}+x_{di}+x_{ei}=n$, $m_{1i}=\boldsymbol{E}_{1i}\times\boldsymbol{Q}_1^{T}/n$, $m_1=\boldsymbol{M}_{11}\times\boldsymbol{R}_{11}^{T}$.

As the same way, m_2 to m_5 can be calculated, and we can get the $\boldsymbol{M}_1$, the teaching evaluation scores $\boldsymbol{S}_1$ can be calculated at the end. It must be explained that the various weight coefficients vector can be setup depend on the requirement.

2) Day-to-Day Teaching Management

Day-to-Day teaching management evaluation vector $\boldsymbol{M}_2=(m_1, m_2, \ldots, m_7)$, here m_1 to m_7 are represented the results given by attitude of the course teaching, the quality and progressing of tasks accomplished, the situation of attend the actions (which include the actions of bilingual teaching and research section, department bilingual course actions), bilingual teaching workload, the quality and progressing of the accomplished for the teaching documentations respectively.

Evaluation vector $\boldsymbol{R}_2 = (r_1, r_2, \ldots, r_7)$, here r_1 to r_7 are represented the weight coefficients of seven evaluating indicator listed above respectively. It reflects the significance grade for each other.

Day-to-Day teaching management evaluation scores: $\boldsymbol{S}_2 = \boldsymbol{M}_2 \times \boldsymbol{R}_2^{\mathrm{T}}$.

The grade of attend the actions and bilingual teaching course should be depend on the assessment regulations. Assume there are n assessments for the teacher, for the m_i–th (i=0,…,7), the assessment results of A, B, C, D, and E are x_{ai}, x_{bi}, x_{ci}, x_{di}, and x_{ei} respectively. Let $\boldsymbol{E}_{1i} = (x_{ai}, x_{bi}, x_{ci}, x_{di}, x_{ei})$, then $x_{ai}+x_{bi}+x_{ci}+x_{di}+x_{ei} = n$, $m_i = \boldsymbol{E}_{1i} \times \boldsymbol{Q}_1^{T}/n$. m_1 to m_5 can be calculated respectively, and we can get the $\boldsymbol{M}_2$, the Day-to-Day teaching management evaluation scores $\boldsymbol{S}_2$ can be calculated at last. The various weight coefficients vector can be setup depend on the requirement too.

3) Bilingual Teaching Construction

Bilingual teaching construction evaluation vector $\boldsymbol{M}_3 = (m_1, m_2, m_3, m_4)$, here m_1 to m_4 are represented the distinction that the teachers were involved in major bilingual course construction, CAI or course Web-sit development, work shop of bilingual course construction, and teaching material editing or organizing respectively. Evaluation weight vector $\boldsymbol{E}_3 = (e_1, e_2, e_3, e_4)$, here e_1 to e_4 are represented the rank coefficients of four evaluating indicator listed above respectively. $\boldsymbol{D}_3 = \boldsymbol{M}_3 \times \boldsymbol{E}_3$ ($\times$ is the multiplication dot of two vectors).

Evaluation vector $\boldsymbol{R}_3 = (r_1, r_2, r_3, r_4)$, here r_1 tor_4 are represented the weight coefficients of four evaluating. It reflects the significance level for each other. Bilingual teaching construction evaluation scores $\boldsymbol{S}_3 = \boldsymbol{D}_3 \times \boldsymbol{R}_3^{\mathrm{T}}$.

The major construction, CAI or course Web-sit development, and work shop of bilingual course construction have four grade which are national, provincial, university, and department level respectively. But the grade segmentation is not need to detailed, such as the major construction does not distinguish between brands and features. The level of national, provincial, university, and department are remarked A, B, C, and D grade, and quantized 90，80，70，and 60 scores respectively, and let $\boldsymbol{Q}_3 = (90, 80, 70, 60)$.

Personal ranks represented by rank coefficients vector. For example, consider $\boldsymbol{W}_3 = (1, 0.7, 0.5, 0.3, 0.1)$, here 1, 0.7, 0.5, 0.3, 0.1 represented the first range, the second range, and so on. Under the fifth range is the same weight 0.1.

4) Course Chosen

Course chosen evaluation vector $\boldsymbol{M}_4 = (m_1, m_2, m_3, m_4)$, here m_1 to m_4 are represented the importance level on the specialty education scheme. The course importance level is represented common basic courses, specialty basic courses, specialty courses, and specialty extension courses respectively. $\boldsymbol{G}_4 = (g_1, g_2, g_3, g_4)$, here g_1 to g_4 are represented the rank weight of the undergraduates grade respectively. $\boldsymbol{D}_4 = \boldsymbol{M}_4 \times \boldsymbol{G}_4$ ($\times$ is the multiplication dot of two vectors). Evaluation vector $\boldsymbol{R}_4 = (r_1, r_2, r_3, r_4)$, here r_1 to r_4 are represented the weight coefficients of four evaluating factors. Course chosen evaluation scores $\boldsymbol{S}_4 = \boldsymbol{D}_4 \times \boldsymbol{R}_4^{\mathrm{T}}$.

5) Teachers English Level

Teachers English level vector $\boldsymbol{M}_5 = (m_1, m_2, m_3)$, here m_1 to m_3 are represented the importance level of English certificate that is TOEFL or IELTS, PETS-5, and CET respectively. $\boldsymbol{Q}_4$ is represented the test score (percentage) of the different type above. $\boldsymbol{D}_5 = \boldsymbol{M}_5 \times \boldsymbol{Q}_5$ ($\times$ is the multiplication dot of two vectors).

Evaluation vector $\boldsymbol{R}_5 = (r_1, r_2, r_3)$, here r_1 to r_3 are represented the weight coefficients of three evaluating factors. Teachers English level scores $\boldsymbol{S}_5 = \boldsymbol{D}_5 \times \boldsymbol{R}_5^{\mathrm{T}}$. If a teacher own more then one English certificate list above, then the highest influence vector will be opted.

6) Teachers English Education Background

Teachers English education background vector $\boldsymbol{M}_6 = (m_1, m_2, m_3)$, here m_1 to m_3 are represented the importance level of English education background that is PhD, MS, and BS respectively. The education level of PhD, MS, and BS are remarked A, B, and C grade, and quantized 95，80，and 65 respectively, and let $\boldsymbol{G}_6 = (95, 80, 65)$. $\boldsymbol{D}_6 = \boldsymbol{M}_6 \times \boldsymbol{G}_6$ ($\times$ is the multiplication dot of two vectors)

Evaluation vector $\boldsymbol{R}_6 = (r_1, r_2, r_3)$, here r_1 to r_3 are represented the weight coefficients of three evaluating factors which can depend on the different university. It reflects the significance level for each other. Teachers English level scores $\boldsymbol{S}_6 = \boldsymbol{D}_6 \times \boldsymbol{R}_6^{\mathrm{T}}$.

If a teacher own more then one degree list above, then the highest degree vector will be opted.

7) Teachers Oversea Working Background

Teachers oversea working background vector $\boldsymbol{M}_7 = (m_1, m_2, m_3, m_4)$, here m_1 to m_4 are represented the time lengths has been oversea. The oversea working background level of more then 5 years, more then 4 years, more then 2 years, and more then 1 year are remarked A, B, C, and D grade, and quantized 95，85，75, and 65 respectively, and let $\boldsymbol{G}_7 = (95, 85, 75, 65)$.

$\boldsymbol{D}_7 = \boldsymbol{M}_7 \times \boldsymbol{G}_7$ ($\times$ is the multiplication dot of two vectors)

Evaluation vector $\boldsymbol{R}_7 = (r_1, r_2, r_3, r_4)$, here r_1 to r_4 are represented the weight coefficients of four evaluating factors depend on the different country. It reflects the significance level for each other.

Teachers oversea working background scores $\boldsymbol{S}_7 = \boldsymbol{D}_7 \times \boldsymbol{R}_7^{\mathrm{T}}$.

8) Achievements of Bilingual Teaching and Research

Achievements of bilingual teaching and research $\boldsymbol{S}_5$ depends on the computational method of the university, calculate the workload of research and teaching first, then determine the grade from A, B, C, or D compared with the basic requirements workload for each positions of teaching and scientific researches. The grade of A, B, C, and D are quantized to 100, 85, 75, and 60 scores. Let $\boldsymbol{Q}_8 = (100, 85, 75, 60)$, and $\boldsymbol{S}_8$ is one of $\boldsymbol{Q}_8$.

9) Awards and Honors

Awards and honors evaluation vector $\boldsymbol{M}_9 = (m_1, m_2)$, here m_1 and m_2 are represented the level of rewards and honors respectively.The levels of awards and honors compose of national, provincial, university, and department respectively. Each level does not been divided any sub-level. For example, the provincial level does not been divided as every department of province. The levels of national, provincial, university, and department are remarked A, B, C, D, and E, and quantized to 100，90，80，70, and 50 scores respectively, and let $\boldsymbol{Q}_9 = (100, 90, 80, 70, 50)$, value m_1 is selected from $\boldsymbol{Q}_9$.

Personal ranks represented by rank coefficients vector. For example, consider $\boldsymbol{W}_3 = (1, 0.7, 0.5, 0.3, 0.1)$, here 1, 0.7, 0.5, 0.3, and 0.1 represented the first range, the second range, and so on. Under the fifth range is the same weight 0.1, value m_2 is selected from $\boldsymbol{W}_3$. Awards and honors evaluation scores $S_9 = \sum m_1 \times m_2$.

10) Other Works

Other works scores $\boldsymbol{S}_{10}$ is been given directly by the assessment group depended on bilingual teaching work situation of the teachers.

3.2. Weights Distribution

The teacher's bilingual working highlights and orientation will be influenced directly by the each weights of the evaluation indicators system, and the dissuasion of the evaluation results will be directly affected. So given a certain weight of scientific and reasonable evaluation factors accorded to the importance is very important. There are several ways to determine the weights of evaluation factors, such as the AHP (Analytic Hierarchy Process), PCA (Principal Component Analysis), FA (Factor Analysis), etc.

3.3. Evaluation Models

Let $\boldsymbol{S} = (\boldsymbol{S}_1, \boldsymbol{S}_2, \ldots, \boldsymbol{S}_{10})$, and weights of bilingual teaching evaluation, Day-to-Day teaching management evaluation, bilingual teaching construction evaluation, course chosen evaluation, teachers English level evaluation, teachers English education background, teachers oversea working background, achievements of

bilingual teaching and research, awards and honors evaluation, and other works evaluation are W_1 toW_{10} respectively, consider the W=(W_1, W_2, …, W_{10}), Then, the total evaluation scores for the teacher Q= S×W^T.

According to the grades and the times on infraction discipline, the grades and the times of the absenteeism and the teaching mistakes, and then use this equation to calculate the total scores, finally, the bilingual teaching course assessment grade can be determined.

4. Conclusion

The bilingual teaching course assessment is a complex and complicated task, the multi-factor and multi-view comprehensive evaluation method which quantized the nondeterministic evaluation indicators to the quantitative results are researched in this papers. It is not only advantageous the statistical analysis, but also reduce the qualitative evaluation of instability and errors. As time changes, a variety of evaluation factors could be changed, so we should focus on the times and let it refresh the bilingual teaching course actual situation. In order to improve working efficiency, given the evaluation results quickly and objectively, we should to have the aid of modern information technologies, collected the evaluation data online, and using the bilingual teaching course evaluation system to accomplish the assessment process.

The bilingual teaching course assessment has used in our department after the comments have collected extensively by computer networks. Evaluation results have been achieved the objectivity and credibility. Our interesting work will focus on the factor analysis, how to determine the weights of the evaluation indicators, and the optimization research on the calculation models.

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